APPENDIX

SPECIFICATION

1. Title of the invention

Clutch housing of tractor

2. Claims

A clutch housing (1) of a tractor, connected to a rear side of an engine, wherein

a bearing case (8) for supporting an interlocking shat (7) that operatively transmitting rotational power from a clutch (4) and a clutch shaft (5) within the clutch housing (1) to an input shaft (6) disposed on a side close to a rear transmission case (3), and a connecting housing (9) for covering the bearing case (8) and the interlocking shaft (7) are detachably mounted at a rear end surface (2) of the clutch housing (1) in such a manner that an inner circumferential surface of the connecting housing (9) and an outer circumferential surface of the bearing case (8) are overlapped to each other.

3. Detailed description of the invention

(Field of the Invention)

This invention is related to a clutch housing of a tractor.

(Prior art and problems to be solved by the invention)

A typical clutch housing is connected to a rear portion of an engine positioned on a rear side of a crank shaft, accommodates a clutch, and is connected at its rear end portion to a transmission case that accommodates a transmission device for transmitting a rotational power to driving axles of rear wheels.

However, for the purpose of weight reduction of the clutch housing

and common use of the clutch housing in different type tractors, there has been proposed a configuration in which the connecting housing connected to the rear portion of the clutch housing and having a rear end connected to the transmission case is made a metal sheet.

This invention is applied to such a configuration in which the clutch housing and the transmission case are connected by the connecting housing made by the metal sheet or the like, and aims to facilitate a connection by the connecting housing and shorten a fore-and-aft direction of the connecting housing.

(Means for solving the problem)

The present invention provides a clutch housing (1) of a tractor, connected to a rear side of an engine, wherein a bearing case (8) for supporting an interlocking shaft that operatively transmitting rotational power from a clutch (4) and a clutch shaft (5) within the clutch housing (1) to an input shaft (6) disposed on a side close to a rear transmission case (3), and a connecting housing (9) for covering the bearing case (8) and the interlocking shaft (7) are detachably mounted to a rear end surface (2) of the clutch housing (1) in such a manner that an inner circumferential surface of the connecting housing (9) and an outer circumferential surface of the bearing case (8) are overlapped to each other.

(Advantage of the invention)

The clutch housing (1) and the transmission case (3) are connected by the connecting housing (9) having a predetermined length and configuration. Within the connecting housing (9), the bearing case (8) that is mounted on a rear side of the clutch housing is bulged so as to support an

interlocking shaft (7) operatively connected to a clutch shaft (5) in the clutch housing (1), the interlocking shaft (7) being operatively connected to an input shaft (6) disposed on a side close to a rear transmission case (3).

The front end portions of the bearing case (8) and the connecting housing (9) are connected to the rear end surface (2) of the clutch housing (1) in a state where an inner circumferential surface of the connecting housing (9) and an outer circumferential surface of the bearing case (8) are overlapped to each other. The configuration makes it possible to effectively utilize the inner space of the connecting housing (9) while shortening lengths in a fore-and-aft direction of the clutch housing (1) and the transmission case (3) by having the bearing case (8) bulged toward the connecting housing (9). The configuration also makes it possible to position mounting surfaces of the bearing case (8) and the connecting housing (9) connected to the rear end surface (2) of the clutch housing (1) substantially at the same position, so that the connection of the bearing case (8) and the connecting housing (9) to the rear end surface (2) of the clutch housing (1) could be eased.

(Embodiments of the Invention)

With reference to Fig. 1, a configuration lying from an engine body constituting a main body of a vehicle body of a tractor to a rear transmission case (10) will be first explained. A clutch housing (1) for accommodating a clutch (4) is connected to a rear end of the engine body. To a rear side of the clutch housing (1), a connecting housing (9), a front transmission case serving as a transmission case (3) and the rear transmission case (10) are connected one another in this order through fastening members such as

bolts. A rear axle housing that accommodates rear axles respectively driving left and right rear wheels is connected to the rear transmission case (10). The rear wheels are differentially driven by having a bevel ring gear (11) of a differential gear device operatively driven through a bevel pinion gear (12). A PTO shaft, which operatively drives a working device connected to the tractor, is connected through a speed change device to a rear end of a PTO interlocking shaft (13) extending from the front transmission case (3) to the rear transmission case (10) so that the PTO shaft is driven with the rotational power whose rotational speed could be changed by the speed change device.

The clutch housing 1 has a rear wall portion (14) supporting a rear end portion of a clutch shaft (5). Between a flywheel (15) driven by the engine and a clutch boss (16) connected to the clutch shaft (5) through a spline connection, a clutch (4) formed by a clutch disk is provided. The clutch (4) is on/off operated in response to a rotation of a clutch shifter (17) around a shifter shaft (18), the clutch shifter (17) being provided at the clutch housing (1).

A bearing case (8) is connected to the clutch housing (1). The bearing case (8) has a peripheral portion that is brought into contact with a rear end surface (2) of the outer peripheral portion of a rear wall portion (14) of the clutch housing (1) and that is fastened to the rear end surface (2) by fastening member such as a bolt. The connecting housing (9) has a front end surface that is brought into contact with and that is fastened to, in a same manner, the rear end surface (2) in a state that the connecting housing (9) surrounds the outer peripheral portion of the bearing case (8). An

interlocking shaft (7) is provided so as to have a front portion extending between the bearing case (8) and the rear wall portion (14) and supported by them. The front portion of the interlocking shaft (7) is connected to the rear end portion of the clutch shaft 5 through gears (19).

The connecting housing (9) is made with a sheet plate, and has a rear end surface that is brought into contact with a front end surface (20) of the front transmission case (3) and that is fastened to the front end surface (20) by fastening member such as a bolt in a same manner. A bearing case (21) having a substantially same configuration as the bearing case (8) is also connected to the front surface of the front transmission case (3). The bearing case (21) supports front portions of an input shat (6), the PTO interlocking shaft (13), a front-wheel PTO shaft (22) or the like. The input shaft (6) is connected to the interlocking shaft (7) through a connecting link (23), the front-wheel PTO shaft (22) is connected at its front end portion to a front-wheel interlocking shaft (24) operatively outputting rotational power toward the front wheels.

The front transmission case (3) has front and rear end portions that are opened, and an intermediate wall portion (25) at a center portion in the fore-and-aft direction. The front end portion is covered with the bearing case (21) and the rear end portion is brought into contact with a front wall portion (26) integrally formed with the rear transmission case (10), so that the front and rear end portions function as bearing portions. An interlocking shaft (27) and a sub speed change shaft (28) are provided coaxially with the input shaft (6), the interlocking shaft (27) being supported by the input shaft (6) and the intermediate wall portion (25), the sub speed

change shaft (28) being supported by the interlocking shaft (27) and the front wall portion (26) of the rear transmission case (10). The bevel pinion gear (12) is mounted on the rear end portion of the sub speed change shaft (28).

The PTO interlocking shaft (13) is directly connected to the input shaft (6) through gears (29), and support in a relatively rotatable manner speed change gears (32)-(34) that are engaged with and rotated by speed change clutches (30), (31) and a gear shaft (35). A main speed change action is performed in response to a fore-and-aft movement of either speed change clutch (30) or (31) to engage and interlock either one of speed change gears (32)-(34) or the gear shaft (35).

The gear shaft (35) integrally includes gears (36), (37) for sub speed change, and also supports in a relatively rotatable manner an intermediate gear (39) engaged with a front-wheel clutch gear (38) on the front-wheel PTO shaft (22). The gear shaft (35) is supported in a rotatable manner around its axis line at its front end portion by the intermediate wall portion (25) and at its rear end portion by the front wall portion (26) of the rear transmission case (10). The front wall portion (26) also supports a rear end portion of the front-wheel PTO shaft (22).

The interlocking shaft (27) supports gears (40)-(42) engaged with the speed change gears (32)-(35). The gear (33) is engaged with the gear (41) through a back gear (43). The sub speed change shaft (28) supports a sub speed change gear (44) in a movable manner along its axis line. A sub speed change action is performed by selectively engaging the sub speed change gear (44) with a gear (42) on the interlocking shaft (27), a gear (36)

on the gear shaft (35), or a gear (46) on the intermediate shaft (47) engaged with the gear (45) that is supported in a relatively rotatable manner on a rear end portion of the sub speed change shaft (28) while being engaged with a gear (37) positioned on a rear end of the gear shaft (35). The power transmission at a time when the sub speed change gear (44) is not engaged with the gear (42) is performed through a roundabout route including the gear (37) of the gear shaft (35), the gear (45) and so on. The front-wheel clutch gear (38) is operatively connected to a front-wheel PTO gear (48) on a rear end of the sub speed change shaft (28).

With respect to Fig. 2, configurations different from the above embodiment will be explained. The bearing case (8) is provided with a reverse device (49) for switching a forward/rearward movement. The bearing case (21) is provided with a full-turn device (50) capable of switching a power-transmitting state from the front-wheel PTO shaft (22) to a front-wheel interlocking shaft (24) to a same-speed state where the front-wheel interlocking shaft (24) is rotated at the same speed as the front-wheel PTO shaft (22) or a increased-speed state where the front-wheel interlocking shaft (24) is rotated at the speed faster than the front-wheel PTO shaft (22). The full-turn device (50) is provided for the purpose of driving one of the front wheels at a high speed in turning the tractor.

The bearing case (21) is detachable from a bearing wall portion (51) mounted on the front end surface (20) of the front transmission case (3), and independently form a transmission case. The bearing wall portion (51) supports the rear end of the input shaft (6), the front end of the interlocking shaft (13) and the front end of the front-wheel PTO shaft (22).

An interlocking shaft (53) is connected through a connecting ring (52) to the front end of the PTO interlocking shaft (13), and supported by the bearing case (21). The interlocking shaft (53) is connected through a connecting ring (54) to a gear shaft (55) supported by the bearing case (8). The gear shaft (55) is connected to reverse gears (56), (57) on the interlocking shaft (7). The rotational direction of the interlocking shaft (7) operatively connected to the gear (19) could be switched into a forward direction or a rearward direction by selectively engaging the reverse clutch (58) with the reverse gears (56), (57). A reference numeral (59) designates a back gear engaged between the gear shaft 55 and the reverse gear (57).

The provision of the reverse device (49) in the bearing case (8) eliminates the use of the speed change gear (33) and the back gear (43) provided in the configuration shown in Fig. 1. The interlocking shaft (13) is operatively driven through the interlocking shaft (53) or the like from the gear shaft (55) in the bearing case (8). Therefore, the speed change clutches (30), (31) of the main speed change device are coaxially with and integrally rotated with a gear (61) that is operatively driven by the input gear (60) on the input shaft (6), and the interlocking shaft (13) is not operatively connected to the input shaft (6) and the gear (61).

The full-turn device (50) includes a clutch (62) for directly connecting between the front-wheel PTO shaft (22) and the front-wheel interlocking shaft (24), and a clutch (64) for connecting the two shafts (22), (24) through a speed change gear (63). The full-turn device (50) is configured to directly transmit the power from the front-wheel PTO shaft (22) to the front-wheel interlocking shaft (24) when the clutch (62) is

engaged, and to increase the rotational speed of the power from the front-wheel PTO shaft (22) through the speed change gear (63) and transmit the same to the front-wheel interlocking shaft (24) when the clutch (64) is engaged. The operation of the clutches (62), (64) is automatically performed in a full-turn mode, using a steering angles sensor of the front wheels or the like.

The clutch housing (1), the connecting housing (9), the transmission case (3) or the like are standardized components so as to be used in the various specification. The configuration makes it possible to effectively utilize the inner space of the connecting housing (9) by changing only the bearing cases (8), (21) or the like. That is, a standard specification as shown in Fig. 1 could be changed to a specific specification including a reverse function, a full-turn function or the like as shown in Fig. 2 by changing only the bearing cases (8), (21) while the standardized components being utilized.

Fig. 3 is different from Figs. 1 and 2 in that the clutch (4) is changed to double clutches. Specifically, a traveling clutch (65) and a PTO clutch (66) are independently provided. The PTO clutch (66) has a clutch shaft (67) supported around the outer circumferential surface of the clutch shaft (5). The clutch shaft (67) has a gear (98) positioned at its rear end portion and operatively engaged with the gear (69) on the interlocking shaft (53), thereby the PTO interlocking shaft (13) is operatively driven by the clutch shaft (67). The gear shaft (55) of the reverse device (49) is mounted on the interlocking shaft (55) in a relatively rotatable manner.

The bearing case (8) in this embodiment is also different from those

of Figs. 1 and 2, but the clutch housing 1, the connecting housing (9), the front transmission case (3) or the like are same as those of Figs. 1 and 2.

Fig. 4 is different from Figs. 1 to 3 in that a hydrostatic transmission (HST) functioning as the main speed change device is provided over the connecting housing (9) and the front transmission case (3). As compared with the above embodiments, the clutch housing (1) and the rear transmission case (10) are same, but the connecting housing (9), the front transmission case (3), the bearing case (8) or the like are different. However, the connecting housing (9) and the bearing case (8) in Fig. 4 are brought into contact with and connected to the rear end surface (2) of the clutch housing (1) in the same manner as the above embodiments.

The hydrostatic transmission (HST) includes an input shaft (70) positioned on a front side and connected to the interlocking shaft (7) of the bearing case (8) through a connecting ring (71), and an output shaft (72) positioned on a rear side and connected to a boss portion of a gear (73) in a relatively non-rotatable manner, the gear (73) being supported by the intermediate wall portion (25). The hydrostatic transmission HST also includes an outer case (74) fixed to a part of the connecting housing (9) through fastening members such as bolts. The reference numeral (76) designates a control shaft for controlling a speed change.

A metal bearing (77) is provided on a front side of the intermediate wall portion (25), so that the boss portion of the gear (73) is sandwiched by the metal bearing (77) and the intermediate wall potion (25). The gear (73) is engaged with the gear shaft (35) supported on the PTO interlocking shaft (13) in a relatively rotatable manner, and the sub speed change shaft (28) is

speed-changed by having the sub speed change gear (44) on the sub speed change shaft (28) selectively engaged with the gear (77), the gear (36) or the gear (45).

The rotational speed of the output of the hydrostatic transmission HST gradually increases in a forward movement as the control shaft (76) is rotated from its neutral position N to a forward movement side F, and gradually decreases as the control shaft (76) is rotated from the forward movement side F to the neutral position N. When the control shaft (76) is rotated in a rearward movement side R, the rotational speed of the output of the hydrostatic transmission HST increases/decreases in a same manner. Therefore, it is not necessary to provide the back gear for traveling the tractor rearwards in the bearing case (8) or sub speed change device.

4. Brief description of the drawings

The drawings show embodiments of the present invention. Fig. 1 is a cross sectional side view of the transmission having a standard specification. Figs. 2 to 4 are respectively cross sectional side views of the transmissions having specific specifications.

(Explanation of reference numerals)

1 clutch housing

2 rear end surface, 3 transmission case

4 clutch, 5 clutch shaft

6 input shaft, 7 interlocking shaft

8 bearing case, 9 connecting housing